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QA Inspections Via Condition Monitoring

A

Guidelines for Quality Assurance Inspection of Commercial Activities Contracts for Real Property Maintenance Activities

Guide #1: Water Systems

by
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A Quality Assurance (QA) Program allows the Army to evaluate and document a contractor's work performance. It depends on a QA Surveillance Plan (QASP). The QASP, which is based on the contract Performance Work Statement, lists contractor activities and the surveillance approach, number of items to be inspected, and an Acceptable Quality Level (AQL) for each activity. This series of 12 guides will help the Contracting Officer's Representative/Quality Assurance Evaluator by defining and clarifying the inspection tasks required by the QASP, which will facilitate inspection uniformity and effectiveness.

This guide discusses QA monitoring of water supply, treatment, and distribution systems, and base swimming facilities.

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FOREWORD

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GUIDELINES FOR QUALITY ASSURANCE INSPECTION OF COMMERCIAL ACTIVITIES CONTRACTS FOR REAL PROPERTY MAINTENANCE ACTIVITIES GUIDE #1: WATER SYSTEMS

1 INTRODUCTION

Background

A Quality Assurance (QA) program allows the Army to evaluate and document a contractor's performance. The Quality Assurance Evaluator (QAE) conducts skilled and carefully planned inspections aimed at verifying the satisfactory completion of contractor work. The inspections evaluate the quality, quantity, and timeliness of the services provided, not the contractor's methods used in performing the work. A good QA program promotes the best possible product within the terms of the standing contract.

A well organized QA program depends on a QA Surveillance Plan (QASP), which is prepared by the Government and contains the purpose and methods of the QA program. Although the QASP is not a part of the contract, it is based on the contract Performance Work Statement, which is part of the contract. The QASP lists contractor activities and the surveillance approach, approximate number of items to be surveyed, and an Acceptable Quality Level (AQL) for each activity.

The installation Director of Public Works (DPW), the Contracting Officer (KO), or the Contracting Officer's Representative (COR), often oversees the QASP. The COR/QAE needs an inspection guide to help define and clarify the inspection tasks required by the QASP, and to facilitate inspection uniformity and effectiveness. To meet this need, the U.S. Army Construction Engineering Research Laboratories (USACERL) developed this series of 12 inspection guides.

Objective

This guide series is intended to supplement any existing QASP and to provide QA guidance for evaluating Operations and Maintenance (O&M) work as performed by contractors on Army property. This water system guide contains recommended surveillance methods that can be amended by direction of the KO or QA management to fit the needs of a specific installation.

Guide Series Organization

This series includes the following guides by USACERL published in October 1993:

- #1: Water Systems**
- #2: Wastewater Systems (Special Report [SR] FF-94/02)**
- #3: Natural Gas Distribution Systems (SR FF-94/03)**
- #4: Electrical Systems (SR FF-94/04)**
- #5: Heating Systems (SR FF-94/05)**
- #6: Ventilation, Air Conditioning, and Refrigeration Systems (SR FF-94/06)**
- #7: Building Services (SR FF-94/07)**
- #8: Grounds Maintenance (SR FF-94/08)**
- #9: Surfaced Areas (SR FF-94/09)**

- #10: Refuse and Recyclable Handling (SR FF-94/10)
- #11: Pest Control Services (SR FF-94/11)
- #12 Custodial Services (SR FF-94/12).

The QAE is expected to evaluate a contractor's performance by applying appropriate visual and instrumentation procedures along with necessary technical and interpretive skills. This guide covers QAE inspection of water systems, and is divided into sections that take the inspector through a step-by-step process of recommended performance indicators, inspection tasks, and surveillance methods.

Water systems are divided into four subsystems in this guide:

1. Water Supply
2. Water Treatment
3. Water Distribution
4. Swimming Facilities.

General QA information, including detailed explanations of the available surveillance methods, is given in Chapter 2.

Chapter 3 provides performance indicators, inspection tasks, and recommended surveillance approaches for each subsystem.

Appendix A contains sampling inspection tables. Appendix B contains QAE Worksheets for each subsystem and a swimming pool questionnaire that may be reproduced for field use.

2 GENERAL QA INSPECTION INFORMATION

Inspection Organization and Planning

According to custom and standard practice, the contractor submits copies of the previous month's O&M activities and regulatory agency reports to the COR and the QAE. The due dates of these reports control the start of inspection scheduling. If possible, the QAE's inspection should be conducted within 3 days after receiving the reports. Effective coordination will allow more efficient inspection of services. The COR/QAE should look for specific indicators of the contractor's performance and should evaluate that performance based on Detailed Inspection Tasks. The following chapter lists the Performance Indicators and Detailed Inspection Tasks for water systems.

Quality Assurance Surveillance Methods

The QAE can use the following five surveillance methods to determine contractor performance:

1. Random Sampling
2. Planned Sampling
3. 100 Percent Inspection
4. Unscheduled Inspection
5. Customer Complaints.

Random Sampling

The methods are based on statistical criteria provided in Military Standard (MIL-STD)-105E, *Sampling Procedures and Tables for Inspection by Attributes* (10 May 1989) and are presented as recommendations. The methods used should be based on the unique needs of an individual system. Generally, all five methods are not used to evaluate an individual system.

Random sampling is recommended for situations where many work items are candidates for inspection. For instance, because it is impractical to inspect every roof on an installation with 500 buildings, only a select number of the buildings should be inspected. Likewise, in random sampling, only a portion of the total performed work is inspected. Acceptance of the work is based on the assumption that the inspected items are representative of the quality of the contractor's work. The random sampling technique spreads the selected samples evenly throughout the evaluation period. The following are steps to be used by the QAE in random sampling.

Tables A1 and A2 in Appendix A should be used to determine the number of samples to be inspected and the number of rejects allowed as a function of the number of inspected work items for AQLs of 4 and 10 percent, and the level of surveillance. The three levels of surveillance are: normal, increased (tightened), and reduced. Initially, this guide recommends normal surveillance for random sampling. However, under the direction of the KO, the level of surveillance can be changed depending on the contractor's performance.

As an example, assume that the contractor's total scheduled output (i.e., population size) for a particular work item is 125 units and that the normal surveillance level with an AQL of 4 percent has been selected. According to Table A1, 20 of the 125 units of work should be inspected, and the entire output of 125 units should be rejected if 3 or more of the 20 sample units are not acceptable.

The QA Worksheets in Appendix B provide room to record the population size, the number of samples, the maximum number of rejects, and the interval for each Performance Indicator.

The work planned by the contractor for each maintenance task should be listed by date to make it easier to predict the time when the work samples will be ready for inspection.

Planned Sampling

Evaluation by planned sampling inspects some, but not all, of the work activities and is appropriate when the number of work items is large. Some items are evaluated before scheduled completion because they are inaccessible after the work is completed. The COR/QAE subjectively selects key work items for inspection; the sample size is determined arbitrarily.

The COR/QAE will normally use planned sampling when the contractor's performance at selected locations or tasks is poor. With this type of evaluation, the contractor knows that work performed in these areas is more likely to be monitored. Planned sampling provides a systematic way of focusing on specific output and forming conclusions about the contractor's performance level.

100 Percent Inspection

Inspection at 100 percent requires total inspection of all items in a contract requirement. It is normally used to monitor infrequent work or critical contract work when the number of work items is small and in cases where nonperformance could seriously damage Army-furnished equipment or processes. It may also be used in areas where a contractor has had prior performance difficulties.

Unscheduled Inspection

Unscheduled inspections can be used for areas of poor past contractor performance, noncritical areas, areas of infrequent repairs, or as a follow-up check of previous inspections. If the QAE notices such an area, an unscheduled inspection can be conducted to evaluate contractor performance.

Customer Complaints

The customer complaint method is based on an informed and cooperative customer population, that is generally aware of local requirements. Customers are expected to monitor contractor services and, when performance is poor or nonexistent, to notify the COR/QAE. If investigation reveals that the complaint is valid, the COR/QAE documents the deficiency. Since this is a reactive QA inspection approach, this method of surveillance normally supplements planned inspection methods.

Increased Surveillance

For areas of poor past contractor performance, the QAE should consult with the KO to intensify the surveillance method. More than one option is usually available, and selection should be based on the initial method and the amount of work performed.

1. Random Sampling (Normal Surveillance) can be replaced by:

- Random Sampling (Increased Surveillance)
- Planned Sampling (for a large population size)

- 100 Percent Inspection (for a small population size)
 - Unscheduled Inspection (for any population size).
2. Planned Sampling can be replaced by:
- Random Sampling (Normal Surveillance)
 - 100 Percent Inspection (for a small population size)
 - Unscheduled Inspection (for any population size).
3. Unscheduled Inspections can be replaced by:
- 100 Percent Inspection (for a small population size)
 - Random Sampling (Normal Surveillance)
 - Planned Sampling.

Decreased Surveillance

For work areas in which the contractor maintains a consistently satisfactory performance for 3 to 6 months, the QAE should consult with the KO to decrease the intensity of the surveillance. More than one option is usually available and selection should be based on the initial method and the amount of work performed.

1. Random Sampling (Normal Surveillance) can be replaced by:
- Random Sampling (Reduced Surveillance)
 - Planned Sampling
 - Unscheduled Inspection (for any population size)
 - Customer Complaints.
2. Planned Sampling can be replaced by:
- Unscheduled Inspection (for any population size)
 - Customer Complaints.
3. 100 Percent Inspection can be replaced by:
- Random Sampling (Normal Surveillance)
 - Random Sampling (Reduced Surveillance)
 - Planned Sampling
 - Unscheduled Inspection (for any population size)
 - Customer Complaints.

3 WATER SYSTEM QA INSPECTIONS

Water Supply

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. The O&M checklists and logs are complete, legible, and timely.

Verify that the contractor's O&M checklists and logs are complete, legible, and timely. All tasks must be listed, dated, designated as completed, and initialed by the person(s) who performed or accepted the work.

2. The water well operating logs are current.

Verify that all water well logs are current and include measurements of static levels, draw down levels, pump flow rates, and chemical feeds. Note and report changes of more than 5 percent of average levels and rates. Logs must also include a record of pump/motor lubrication.

3. Equipment is adequately lubricated.

Verify that all equipment is adequately lubricated. Visually check the well pump packing glands for excessive leakage and the oil reservoirs and grease fittings for proper lubrication. Oil reservoirs should be more than half full, and sight glasses should allow observation of actual lubricant feed while the machinery is running. Check that grease fittings are clean and bright, indicating regular use, and that they have a small amount of residual grease on their surfaces as a sign of recent lubrication.

4. The pipe networks around all water wells show no signs of leakage.

Visually verify that pipe networks around all water wells show no signs of leakage.

5. No well pump exhibits irregular noise or vibration during or immediately after operation.

Verify that no well pump exhibits irregular noise or vibration during or immediately after pump operation. Noise or excessive vibration might indicate a problem with the pump's bearings or shaft alignment. QA instrumentation is recommended (Johnson 1993) to measure the well pump's bearing condition, motor vibration, and shaft vibration (indicating misalignment).

6. Well pump air inlets, air impellers, and heat exchange surfaces are clean.

Visually check well pump air inlets, air impellers, and heat exchange surfaces for dirt and dust that may impede the pump from functioning efficiently.

7. During peak cold spells, the temperature inside each well house is not below 50 °F.

During a period of peak cold weather, verify that air temperature readings taken inside each well house are not below 50 °F.* Recording instrumentation is recommended.

8. "As-built" drawings are updated with changes and corrections.

Verify that the contractor maintains current "as-built" drawings of water supply facilities and equipment. Check to see that the drawings are updated annually with all changes and corrections. The draftperson's initials and the date should accompany each change.

9. An adequate library of equipment manufacturers' manuals is being maintained.

Verify that the contractor maintains an adequate library of manufacturers' manuals for equipment and facilities. Manuals should be obtained for newly installed equipment and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicators #1 through #5 monthly using the 100 percent inspection method.
- Evaluate performance indicator #6 periodically using the unscheduled inspection method.
- Evaluate performance indicator #7 seasonally using the 100 percent inspection method.
- Evaluate performance indicators #8 and #9 annually using the 100 percent inspection method.

Water Treatment

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. The O&M checklists and logs are complete, legible, and timely.

Verify that the contractor's O&M checklists and logs are complete, legible, and timely. All performed tasks must be listed, dated, designated as completed, and initialed by the person(s) who performed or accepted the work.

2. Water treatment plant operations and testing logs are current.

Verify that operating logs for the water treatment plant are current.

- a. Testing records must include:

- Taste and odor acceptability
- pH levels
- Residual free available chlorine

*A metric conversion table is on p 13.

- Raw water turbidity
- Finished water turbidity
- Pressure readings.

b. Operational records must include:

- Chemical doses
- Chlorine feed rates
- Filter backwash frequencies and flow rates
- Meter readings
- Motor power uses
- Other requirements specific to the facility.

Compare operating logs to the required performance standards and report any significant deviations. Consult with the KO regarding the definition of a significant deviation. Confirm that the contractor's report indicates deviations, measures taken to correct the deviations, and the results of the corrections. Selectively repeat some tests for verification.

3. Equipment is adequately lubricated.

Verify that all equipment is adequately lubricated. Visually check the oil reservoirs and grease fittings to verify lubrication. Oil reservoirs should be more than half full, and sight glasses should allow observation of actual lubricant feed while the pump is running. Check that grease fittings are clean and bright, indicating regular use, and that they have a small amount of residual grease on their surfaces from recent lubrication.

4. The pipe networks within all water treatment plants show no signs of leakage.

Visually verify that pipe networks within all water treatment plants show no signs of leakage.

5. No rotary equipment exhibits irregular noises or vibrations during operation.

Verify that no rotary equipment exhibits irregular noises or vibrations during operation. Noise or excessive vibration might indicate a problem with the bearing or shaft alignment. QA instrumentation is recommended to measure the rotary equipment's bearing condition, motor vibration, and shaft vibration (indicating misalignment) when a problem is suspected.

6. During peak cold spells, the temperature inside each water treatment plant is not below 50 °F.

During a period of peak cold weather, verify that air temperature readings taken inside each water treatment plant are not below 50 °F. Recording instrumentation is recommended.

7. "As-built" drawings are updated with changes and corrections.

Verify that the contractor maintains current "as-built" drawings of water treatment facilities and equipment. Check to see that the drawings are updated annually with all changes and corrections. The draftperson's initials and the date should accompany each change.

8. An adequate library of equipment manufacturer's manuals is being maintained.

Verify that the contractor maintains an adequate library of manufacturers' manuals for equipment and facilities. Manuals should be obtained for newly installed equipment, and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicators #1 through #5 monthly using the 100 percent inspection method.
- Evaluate performance indicator #6 seasonally using the 100 percent inspection method.
- Evaluate performance indicators #7 and #8 annually using the 100 percent inspection method.

Water Distribution

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. Water distribution O&M documentation is complete, legible, and timely.

Verify that the contractor's water distribution O&M documentation is complete, legible, and timely. Check to see that normal activities are performed and logs are initialed by the operator(s).

The documentation should cover, as a minimum, the following:

- Fire hydrant and dead end main flushing
- Valve exercising
- Water leaks
- Cross-connection problems
- Miscellaneous water problems.

Discuss with the contractor the probable causes of major water main leaks or other water problems, and be sure the contractor records the method and materials used for any repairs. Visit the sites of major water leaks and reported cross-connections. Excavation at potential cross-connections that could contaminate the water distribution system should not be backfilled until the KO has evaluated the correction by a site visit.

2. An adequate spare parts inventory is being maintained in case of emergency repairs.

Verify that the contractor is maintaining an adequate inventory of water distribution spare parts (i.e., piping, fittings, valves, etc.) for emergency repairs. The number and types of spare parts should be determined locally based on the installed equipment records and appropriate recommendations/advice found in TM 5-660, TM 5-661, and TM 5-813-5. All water main sizes should be represented.

3. Water samples are collected, submitted for testing, and verified as acceptable water quality.

Verify that water samples are collected and submitted as required by the contract and by regulatory agencies. The contractor must provide test results for review by the QAE. Monthly, check water quality reports and logs for completeness and compare with previous reports for changes. Verify that the reported water quality meets desired standards.

Randomly select a location on the installation to collect an independent water sample using a bottle and instructions provided by a local licensed testing laboratory. Have the sample tested for both chemical and biological content, including turbidity, fluorine, and available chlorine. The laboratory results must verify the contractor's reports.

4. Equipment is adequately lubricated.

Verify that all continuous service pumps are adequately lubricated. Visually check the high service pump packing glands for excessive leakage and the oil reservoirs and grease fittings for proper lubrication. Oil reservoirs should be more than half full, and sight glasses should allow observation of actual lubricant feed while the pump is running. Check that grease fittings are clean and bright, indicating regular use, and that they have a small amount of residual grease on their surfaces from recent lubrication.

5. No continuous service pump exhibits irregular noise or vibration during operation.

Verify that no continuous service pump exhibits irregular noise or vibration during or immediately after pump operation. Noise or excessive vibration might indicate a problem with the bearing or shaft alignment. QA instrumentation is recommended (Johnson 1993) to measure the continuous service pump's bearing condition, motor vibration, and shaft vibration (indicating misalignment).

6. Residential and commercial water meters pulled for service are cleaned, calibrated, and/or repaired.

Review contractor documentation to verify that maintenance is performed on residential and commercial water meters pulled for service. Check that meters are cleaned, calibrated, and/or repaired. Verify that meters beyond repair are properly replaced.

7. If required, the contractor collects, records, and submits monthly readings for all water customers.

When required by the contract, verify that the contractor collects, records, and submits monthly readings for all customers. Use the listing of metered water users and the random sampling procedures to select the water meters to be checked. Collect the meter readings from the selected locations and compare them with those furnished by the contractor. The readings should agree, with allowance for water use between the dates of the two readings. Check to see that excessively high customer or master meter readings are satisfactorily explained or resolved.

8. Water control valves are exercised.

Verify that all water control valves are exercised annually. Check that the contractor keeps a record of the date, the number of turns to close, and the number of turns to open for each valve exercised. The KO should specify the month of valve exercising.

During the month of valve exercising, randomly select two regular working days and a backup day to inspect the contractor's work. Without notifying the contractor, locate the work crew performing valve exercising and observe their operations. Check to see that each valve is operated to the fully closed position and then returned to the fully open position. The number of revolutions required for full travel of the valve mechanism must be appropriate for the valve's size. Consult the water distribution map for the water main size in which the valve is located. Normally, the valve size and the main size will be the same. Deviations from normal revolutions may show a need for valve repair or replacement, but this does NOT reflect adversely on the contractor's performance of this task. Notify the KO of any possible malfunctioning valves.

9. Fire hydrants and dead ends are flushed and flow-tested annually.

Verify the contractor's records to see that all fire hydrants and dead-end water mains are flushed annually. Flushing is done to ensure that fire hydrants can provide an adequate water flow and that dead-end water mains do not contain stagnant water.

During the flushing operation, conduct an unscheduled inspection of the contractor's procedure at two or more locations. Check to see that hydrants and dead-ends are flushed for 10 minutes after the water is visibly free of rust or other turbidity. Verify that a rate-of-flow measuring device is attached to the largest connection on each hydrant.

The measured flow rate should be within 10 percent of the standard for that size hydrant. For example, the flow rate for a new standard 6-in. fire hydrant with a standard 5-1/4-in. valve opening when supplied through a 4-1/2-in. pumper nozzle is as follows:

<u>Pressure, in psi</u>	<u>Flow Rate, in gpm</u>
20	1450
50	2250
75	2800
100	3200

10. Emergency repairs of the water distribution system are adequately performed, restoring service as soon as practical, including disinfections of affected sections of the system.

Examine contractor records to verify that the contractor responds to all emergency repair work in a timely manner and works diligently to restore service. Check to see that all water mains depressurized during repair work are disinfected according to American Water Works Association Standard C651-86 (Including addendum C651a-90), entitled *Disinfecting Water Mains*, before being returned to service. Visit the repair site to see that it is clear of construction debris and that excavated areas are graded to match the surrounding area. Plan an unscheduled return visit to verify that excavated areas that might have settled have been reshaped.

11. Continuous service pump air inlets, air impellers, and heat exchange surfaces are clean.

Visually check continuous service pump air inlets, air impellers, and heat exchange surfaces for dirt and dust that may impede the pump from functioning efficiently.

12. Water storage tanks are cleaned and sanitized annually.

During the annual cleaning and sanitizing of the water storage tanks, make periodic visits to observe the isolation, draining, cleaning, disinfection, and restoration to service of all tanks.

13. Cathodic protection for storage tanks and underground piping is adequate.

Check all storage tank and underground piping cathodic protection equipment to ensure that adequate protection against corrosion still exists.

14. "As-built" drawings are updated with changes and corrections.

Verify that the contractor is maintaining current "As Built" drawings of water distribution facilities and equipment. Check to see that the drawings are updated annually with all changes and corrections. The draftperson's initials and the date should accompany each change.

15. An adequate library of equipment manufacturers' manuals is being maintained.

Verify that the contractor maintains an adequate library of manufacturers' manuals for equipment and facilities. Manuals should be obtained for newly installed equipment, and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicators #1 through #6 monthly using the 100 percent inspection method.
- Evaluate performance indicator #7 monthly using random sampling (normal surveillance, 10 percent AQL).
- Evaluate performance indicators #8 through #11 periodically using the unscheduled inspection method.
- Evaluate performance indicators #12 through #15 annually using the 100 percent inspection method.

Swimming Facilities

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. The contractor responds within approximately 2 hours after all requests from a lifeguard for pool maintenance.

Furnish a copy of the swimming pool questionnaire to the lifeguard supervisor or use the questionnaire to conduct an interview. The interview or questionnaire should note any

instances where the contractor did not respond promptly (i.e., within approximately 2 hours) to any requests for pool maintenance.

2. Pool chlorination levels are inspected and adjusted daily.

Review the contractor's log of pool chlorination level inspections and adjustments. All adjustments should be made between 0700 and 0900 each day the pool is in operation.

3. Three pool samples are collected weekly, tested for bacteria, and reported to the KO.

Review the contractor's log for water sampling results. Verify that the contractor collects three pool water samples each week, has them tested by an approved licensed laboratory for bacteriological content, and submits the results to the KO.

4. Pumps, filters, and other equipment were operated, maintained, backwashed, and recharged as needed.

Review the contractor's O&M performance log for the swimming facilities. In addition to normal O&M items, check the logs for a record of backwashing, recharging, and repairs. Perform a field inspection of the pools and equipment if the response to the lifeguard questionnaire indicates any problems or if users complain about water quality or pool maintenance. Evaluate the contractor's performance based on the following indicators.

- a. Confirm that the wading pools and swimming pools contain water that allows a clear view of the bottom, and that the bottom is free of sand, leaves, or other debris.
- b. Analyze a sample of water from each pool for chlorine and bacteriological content according to the local public health agency requirements.
- c. Inspect the pool filter room
 - (1) Check that the area is clean and neatly arranged.
 - (2) While the filter pump is running, listen for an unpleasant whining or grinding sound, indicating damage or lack of lubrication.
 - (3) While the filter pump is running, record the inlet and outlet pressures on the gauges. A pressure difference between the two readings of greater than 25 psi is unsatisfactory and indicates that the contractor should backwash the filters more often.
 - (4) Visually inspect lubrication points for a clean, bright appearance indicating regular attention.

5. No pumps or rotary machines exhibit irregular noises or vibrations during operation.

Verify that no pumps or rotary machines exhibit irregular noises or vibrations during or immediately after operation. Noise or excessive vibration might indicate a bearing or shaft alignment problem. QA instrumentation is recommended (Johnson 1993) to measure the pump's and rotary machine's bearing condition, motor vibration, and shaft vibration (indicating misalignment).

6. The pools, bathhouse, and equipment are winterized or dewaterized as scheduled.

Visit the pool facilities with the contractor's operator after Labor Day (or whenever the swimming season ends) to verify that the pools and equipment are completely winterized. This work requirement is very important in cold climates where winter freezing will seriously damage the equipment. Also, visit the pools with the contractor and the pool supervisor immediately before Memorial Day (or whenever the swimming season begins) to verify that the pools and equipment are dewaterized and ready for use.

7. The wading pools are drained, cleaned, and refilled daily.

Review the contractor's performance log for O&M of the wading pools. In addition to normal O&M items, confirm that the logs include a record of draining, cleaning, and refilling of the pools for each day the pool is in operation.

8. "As-built" drawings are updated with changes and corrections.

Verify that the contractor maintains current "as-built" drawings of swimming pool facilities and equipment. Check to see that the drawings are updated annually with all changes and corrections. The draftperson's initials and the date should accompany each change.

9. An adequate library of equipment manufacturers' manuals is being maintained.

Verify that the contractor maintains an adequate library of manufacturers' manuals for equipment and facilities. Manuals should be obtained for newly installed equipment, and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicator #1 monthly using questionnaire feedback.
- Evaluate performance indicators #2 through #5 and #7 monthly using the 100 percent inspection method.
- Evaluate performance indicator #6 seasonally using the 100 percent inspection method.
- Evaluate performance indicators #8 and #9 annually using the 100 percent inspection method.

METRIC CONVERSION TABLE

1 in.	=	2.54 cm
1 gal	=	3.78 L
1 psi	=	6.89 kPa
°F	=	(°C + 17.78) x 1.8

ACRONYMS

AQL	Acceptable Quality Level
COR	Contracting Officer's Representative
DEH	Director of Engineering and Housing
KO	Contracting Officer
MIL-STD	Military Standard
O&M	Operations and Maintenance
QA	Quality Assurance
QAE	Quality Assurance Evaluator
QASP	QA Surveillance Plan

REFERENCES

- Johnson, James, Special Report FF-93/DRAFT, *Catalog of Industrial Instrumentation for Army Real Property Quality Assurance Applications* (U.S. Army Construction Engineering Research Laboratory, 1993).
- Military Standard 105E, *Sampling Procedures and Tables for Inspection by Attributes* (Department of Defense, 10 May 1989).
- Technical Manual (TM) 5-660, *Maintenance and Operation of Water Supply, Treatment, and Distribution Systems* (Headquarters, U.S. Army Corps of Engineers [HQUSACE], 30 August 1984).
- TM 5-661, *Inspection and Preventive Maintenance Services for Water Supply Systems at Fixed Installations* (HQUSACE, 21 September 1945).
- TM 5-813-5, *Water Supply: Water Distribution* (HQUSACE, 3 November 1986).

APPENDIX A: Inspection Sampling Tables

Table A1

Sample Sizes and Reject Levels (4% AQL)
(As developed from Tables I & II in MIL STD 105E)

Population Size	Normal Surveillance			Increased (Tightened) Surveillance			Reduced Surveillance		
	Class II Sample Size	Reject Level		Class III Sample Size	Reject Level		Class I Sample Size	Reject Level	
08 to 50	*	25%	1	*	40%	1	*	-	-
51 to 90	E	13	2	F	20	2	*	3%	1
91 to 150	F	20	3	G	32	3	*	3%	1
151 to 280	G	32	4	H	50	4	E	5	2
281 to 500	H	50	6	J	80	6	F	8	3
501 to 1200	J	80	8	K	125	9	G	13	4
1201 to 3200	K	125	11	L	200	13	H	20	5

The Reject Level is the number of failed inspections requiring rejection of the Lot (population).
An asterisk (*) indicates that the sample level is outside the range of a 4% AQL for the selected class.

Table A2

Sample Sizes and Reject Levels (10% AQL)
(As developed from Tables I & II in MIL STD 105E)

Population Size	Normal Surveillance			Increased Tightened Surveillance			Reduced Surveillance		
	Class II Sample Size	Reject Level		Class III Sample Size	Reject Level		Class I Sample Size	Reject Level	
06 to 15	*	33%	1	*	50%	1	*	-	-
16 to 25	C	5	2	D	8	2	*	8%	1
26 to 50	D	8	3	E	13	3	C	2	2
51 to 90	E	13	4	F	20	4	C	2	2
91 to 150	F	20	6	G	32	6	D	3	3
151 to 280	G	32	8	H	50	9	E	5	4
281 to 500	H	50	11	J	80	13	F	8	5
501 to 1200	J	80	15	K	125	19	G	13	6
1201 to 3200	K	125	22	L	200	19	H	20	8

The Reject Level is the number of failed inspections that require rejection of the Lot (population).
An asterisk (*) indicates that the sample level is outside the range of a 10% AQL for the selected class.

Table A3

Random Numbers

2	6	1	6	9	3	5	5	1	1	3	1	2	5	5	1	7	8	7	5	6	6	8	4	4	9	4	6	2	8	9	3	5
1	8	1	4	5	9	2	7	2	2	5	4	9	1	9	2	9	4	9	2	9	3	6	3	5	1	4	3	1	1	1	6	1
4	2	3	6	8	4	6	3	2	6	6	8	8	5	4	9	1	1	3	2	8	6	1	9	8	7	1	2	4	3	4	1	3
2	7	2	4	8	8	8	3	5	3	3	2	6	3	9	3	2	7	7	1	8	3	5	9	6	8	1	5	9	3	2	4	6
8	4	1	3	7	4	4	6	1	6	9	6	3	7	5	6	2	1	4	3	2	8	5	7	8	2	4	7	7	7	4	2	6
2	6	4	8	1	5	4	9	7	1	7	3	3	7	2	1	7	4	4	7	7	8	2	7	5	7	6	5	6	6	2	5	8
1	9	8	6	9	6	8	3	7	5	4	1	3	6	1	1	3	3	2	8	7	5	4	1	9	1	4	9	7	1	8	4	8
1	4	3	7	5	6	5	5	9	9	4	6	4	6	2	3	4	5	8	9	9	9	8	3	2	3	2	7	7	5	9	9	8
8	3	6	3	8	6	3	8	9	6	1	9	3	9	8	3	9	8	5	6	4	9	5	8	7	4	3	7	8	2	3	8	4
1	5	2	5	8	3	7	5	2	3	7	9	4	4	4	4	8	3	1	2	6	7	2	9	9	7	8	4	2	3	4	1	4
1	5	7	2	9	4	2	5	6	4	8	6	1	3	5	4	5	1	9	2	2	1	5	9	7	5	7	6	7	5	5	6	3
6	9	2	7	1	9	7	7	5	4	3	6	6	3	6	3	4	4	6	6	8	3	8	1	4	7	9	1	4	7	2	7	7
2	5	5	8	6	6	7	8	5	8	2	6	2	4	3	2	7	6	6	1	7	4	3	2	8	4	8	9	3	1	7	7	7
6	1	1	9	1	9	2	9	9	9	1	2	8	6	4	7	3	7	5	4	7	1	8	1	3	4	2	1	5	9	2	5	7
9	9	5	1	1	4	8	9	9	8	2	6	9	3	3	2	5	9	5	7	9	6	2	8	3	1	1	9	3	3	1	6	2
9	6	1	8	8	7	7	8	3	2	2	5	2	6	3	6	6	4	5	2	2	8	1	3	3	2	3	3	6	9	3	9	4
2	2	8	7	7	3	8	1	7	8	2	8	8	3	3	9	8	5	7	1	7	3	6	2	7	6	5	9	6	8	2	7	7
3	9	6	7	1	1	4	7	3	6	9	2	7	4	8	8	3	2	5	8	4	2	2	9	1	4	8	4	6	5	3	6	4
3	6	4	2	9	6	4	4	6	9	7	8	8	4	7	3	5	5	1	7	9	5	9	8	4	8	7	1	1	3	2	5	8
7	6	5	6	3	1	9	7	8	9	8	1	7	6	8	8	9	3	5	8	3	1	9	4	6	7	4	2	7	4	7	9	8
5	4	7	2	8	9	2	7	2	1	3	5	6	1	9	6	8	3	7	8	9	9	6	5	9	6	4	8	7	5	9	5	5
2	2	6	5	1	1	3	3	7	6	1	7	4	4	4	9	5	2	5	9	1	7	2	5	4	9	9	4	9	9	8	8	2
4	6	6	8	6	4	6	1	5	4	6	3	9	6	8	4	5	6	2	4	2	4	1	8	3	8	4	3	5	9	5	9	6
4	5	7	4	1	8	8	2	3	5	6	3	5	3	2	1	8	2	9	2	5	6	5	1	9	9	4	8	4	4	4	4	5
9	9	9	1	1	9	5	8	9	9	8	9	8	3	4	7	9	1	2	5	7	5	3	6	5	4	2	3	1	8	8	3	5
2	2	7	4	6	8	2	2	5	9	4	4	2	3	7	9	5	7	7	8	8	1	3	1	4	3	1	1	6	1	2	5	8
8	5	7	3	9	8	7	9	2	2	1	9	7	9	8	6	1	1	9	8	5	3	6	4	3	3	9	6	3	8	1	5	1
7	9	4	2	3	8	6	1	7	6	7	5	3	4	3	5	2	1	4	7	6	9	1	8	9	2	4	4	3	7	4	8	1
1	3	7	8	6	8	7	8	9	9	3	3	1	6	3	3	8	4	3	3	4	8	1	8	6	3	4	9	9	8	4	5	4
5	4	7	4	9	3	7	3	1	9	2	3	8	7	3	8	9	2	5	1	5	9	4	2	4	9	1	9	9	8	1	7	9
7	6	7	6	2	7	3	2	5	7	9	3	4	4	4	2	6	1	5	2	4	5	1	7	9	9	2	8	6	6	8	8	5
8	4	6	5	9	2	1	3	5	5	1	7	8	6	1	7	9	8	3	6	6	9	1	7	9	2	2	9	6	7	1	5	3
2	3	6	2	7	9	5	6	2	9	7	2	4	2	7	4	7	7	5	4	6	9	7	5	1	9	9	1	2	9	6	7	5
6	2	2	4	5	8	2	9	4	9	5	6	2	6	3	6	2	6	6	2	1	3	9	6	8	4	6	1	4	2	5	7	4
6	3	5	4	9	1	1	2	1	2	7	1	1	5	9	1	1	7	2	3	2	1	1	7	9	5	5	3	8	7	8	9	1
2	4	7	6	7	9	3	2	2	2	8	1	3	4	2	9	8	7	6	9	5	7	8	6	5	8	5	3	6	8	6	2	
6	9	1	7	1	4	6	4	7	6	5	8	5	4	9	4	8	8	4	5	5	8	1	7	9	5	9	3	2	1	3	7	6
4	8	4	1	9	8	6	4	7	4	4	1	5	9	2	4	3	3	6	7	4	8	9	2	1	5	4	3	7	2	5	1	2
2	1	6	8	6	8	3	6	1	4	5	7	9	6	8	7	2	3	8	6	2	9	9	1	3	4	7	5	4	4	3	9	8
9	8	5	4	5	6	1	4	3	6	2	9	6	1	9	8	1	8	8	9	9	9	5	1	7	4	9	2	1	9	1	6	6
5	3	2	7	5	6	1	3	3	3	5	4	1	2	4	6	2	3	3	2	5	7	9	1	8	3	8	4	6	1	1	1	6
2	2	7	7	2	5	7	2	6	1	1	2	1	6	1	8	6	6	8	1	2	1	4	8	5	2	8	4	1	1	7	3	9
2	8	9	4	9	9	6	8	4	3	2	3	9	9	4	7	3	2	4	1	9	6	5	4	1	8	5	3	7	7	3	6	9
2	3	4	9	7	5	3	2	4	6	4	4	6	8	6	3	1	1	8	9	6	4	7	7	6	3	1	5	7	8	9	7	7
6	7	9	5	5	8	5	4	4	5	6	1	4	9	4	5	3	1	7	3	2	1	8	6	2	2	4	7	8	1	4	5	9
5	3	7	8	6	6	4	1	1	4	4	2	5	1	1	4	8	9	4	2	8	9	9	7	2	4	7	8	4	1	8	1	1
7	2	3	2	1	7	2	8	6	4	6	9	7	3	9	3	3	4	4	7	1	4	4	8	8	6	7	4	1	9	9	5	1
8	4	3	4	9	2	7	2	6	3	7	9	8	3	1	9	9	5	8	7	1	2	9	9	6	6	8	8	8	7	8	4	8

APPENDIX B: QAE Inspection Worksheets

Water Supply Worksheet

Page 1 of 5

Performance Indicator #1: The O&M checklists and logs are complete, legible, and timely.

- a. All items are listed, dated, and initialed as completed.

S U N

- b. The checklists and logs are timely.

S U N

Remarks:

Performance Indicator #2: The water well operating logs are current.

- a. The logs include measurements of static levels.

S U N

- b. The logs include measurements of drawdown levels.

S U N

- c. The logs include measurements of filter backwash frequencies and pump flow rates.

S U N

- d. The logs include measurements of chemical and chlorine feeds.

S U N

- e. The logs include a record of pump/motor lubrication and power use.

S U N

f. Test records include information on taste and odor acceptability, pH levels, residual free available chlorine, raw and finished water turbidity, and pressure readings.

S U N

Remarks:

Performance Indicator #3: Equipment is adequately lubricated.

- a. Oil reservoirs are more than half full.
- b. Sight glasses allow observation of actual lubricant feed while the machinery is running.
- c. Grease fittings are clean and bright with a slight grease residual.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #4: The pipe networks around all water wells show no signs of leakage.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #5: No well pump exhibits irregular noise or vibration during or immediately after operation.

- a. The pumps do not make irregular noises or vibrations during or immediately after operation.
- b. Motor vibration, bearing condition, and shaft vibration measurement devices do not indicate any problems.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #6: Well pump air inlets, air impellers, and heat exchange surfaces are clean.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #7: During peak cold spells, the temperature inside each well house is not below 50 °F.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #8: "As-built" drawings are updated with changes and corrections.

a. The draftperson's initials accompany each change.

S U N

b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #9: An adequate library of equipment manufacturers' manuals is being maintained.

- a. Manuals for new equipment have been obtained.

S U N

- b. Obsolete manuals have been properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

Performance Indicator #1: The contractor's O&M checklists and logs are complete, acceptable, and timely.

- a. All items are listed, dated, and initialed as completed.

S U N

- b. The checklists and logs are timely.

S U N

Remarks:

Performance Indicator #2: Water treatment plan operations and testing logs are current.

- a. No significant deviations exist between the logs and the required performance standards.

S U N

- b. The contractor reported measures taken to correct any deviations.

S U N

Remarks:

Performance Indicator #3: Equipment is adequately lubricated.

- a. Oil reservoirs are more than half full.
- b. Sight glasses allow observation of actual lubricant feed while the pump is running.
- c. Grease fittings are clean and bright with a slight grease residual.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #4: The pipe networks within all water treatment plants show no signs of leakages.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #5: No rotary plant equipment exhibits irregular noises or vibrations during operation.

- a. Rotary equipment does not make irregular noises or vibrations while operating.
- b. Motor vibration, bearing condition, and shaft vibration measurement devices do not indicate any problems.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #6: No plant equipment exhibits abnormally high operating temperatures.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #7: During peak cold spells, the temperature inside each water treatment plant is not below 50 °F.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #8: All water treatment equipment, pipe networks, and pertinent surfaces are free of corrosion and have adequate protective coatings.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #9: "As-built" drawings are updated with changes and corrections.

a. The draftperson's initials accompany each change.

S U N

b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #10: An adequate library of equipment manufacturer's manuals is being maintained.

a. Manuals for new equipment have been obtained.

S U N

b. Obsolete manuals have been properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

Performance Indicator #1: Water distribution O&M documentation is complete, legible, and timely.

- a. The documentation includes fire hydrant and dead end main flushing.

S U N

- b. The documentation includes valve exercising.

S U N

- c. The documentation includes water leaks.

S U N

- d. The documentation includes cross-connection problems.

S U N

- e. The documentation includes miscellaneous water problems.

S U N

- f. The documentation is timely.

S U N

Remarks:

Performance Indicator #2: An adequate spare parts inventory is being maintained in case of emergency repairs.

S U N

Remarks:

Performance Indicator #3: Water samples are collected, submitted for testing, and verified as acceptable water quality.

- a. Reports from the contractor are timely.

S U N

- b. Logs are complete.

S U N

- c. Water samples verify acceptable water quality.

S U N

Remarks:

Performance Indicator #4: Equipment is adequately lubricated.

- a. Oil reservoirs are more than half full.

- b. Sight glasses allow observation of actual lubricant feed while the pump is running.

- c. Grease fittings are clean and bright with a slight grease residual.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #5: No continuous service pump exhibits irregular noise or vibration during operation.

- a. Continuous service pumps do not make irregular noises or vibrations while operating.
- b. Motor vibration, bearing condition, and shaft vibration measurement devices do not indicate any problems.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #6: Residential and commercial water meters pulled for service are cleaned, calibrated, and/or repaired.

- a. Meters are cleaned, calibrated, and/or repaired.
- b. Meters beyond repair are properly replaced.

S U N

S U N

Remarks:

Performance Indicator #7: If required, the contractor collects, records, and submits monthly readings for all water customers.

- a. QAE readings agree with contractor readings.
- b. Unusually high usages are identified, investigated, and resolved.

Using the population size_____, and referring to normal surveillance in Tables A1 and A2 gives_____number of samples and_____number of allowable rejects.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #8: Water control valves are exercised.

a. Records include the date, the number of turns to close, and the number of turns to open for each valve exercised.

b. The contractor's valve exercising performance is satisfactory.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #9: Fire hydrants and dead ends are flushed and flow-tested annually.

a. Hydrants and dead ends are flushed for 10 minutes after the water is visibly free of rust and other turbidity.

b. Rate-of-flow measurements verify adequate hydrant flow.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #10: Emergency repairs of the water distribution system are adequately performed, restoring service as soon as practical, including disinfections of affected sections of the system.

- a. The contractor responds to all repair work in a diligent and timely manner.
- b. Depressurized water mains are disinfected before being returned to service.
- c. Excavated areas have been graded and shaped.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #11: Continuous service pump air inlets, air impellers, and heat exchange surfaces are clean.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Water Distribution Worksheet

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Performance Indicator #12: Water storage tanks are cleaned and sanitized annually.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #13: Cathodic protection for storage tanks and underground piping is adequate.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

Remarks:

Performance Indicator #14: "As-built" drawings are updated with changes and corrections.

- a. The draftperson's initials accompany each change.

S U N

- b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #15: An adequate library of equipment manufacturers' manuals is being maintained.

- a. Manuals for new equipment have been obtained.

S U N

- b. Obsolete manuals have been properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

Performance Indicator #1: The contractor responds within approximately 2 hours after all requests from a lifeguard for pool maintenance.

S U N

Remarks:

Performance Indicator #2: Pool chlorination levels are inspected and adjusted daily by the contractor.

S U N

Remarks:

Performance Indicator #3: Three pool samples are collected weekly, tested for bacteria, and reported to the KO.

a. The samples are tested by a licensed laboratory.

S U N

b. The bacteriological content of the samples is below safe levels.

S U N

Remarks:

Performance Indicator #4: Pumps, filters, and other equipment are operated, maintained, backwashed, and recharged as needed.

- a. The wading pools and swimming pools contain clear water and are free of debris.

S U N

- b. A sample of water from each pool is analyzed with satisfactory test results.

S U N

- c. The filter room is adequately operated and maintained.

S U N

Remarks:

Performance Indicator #5: No pumps or rotary machines exhibit irregular noises or vibrations during operation.

- a. Pumps do not make irregular noises or vibrations while operating.

S U N

- b. Motor vibration, bearing condition, and shaft vibration measurement devices do not indicate any problems.

S U N

Remarks:

Performance Indicator #6: The pools, bathhouse, and equipment are winterized or dewatered as scheduled.

S U N

Remarks:

Performance Indicator #7: The wading pools are drained, cleaned, and refilled daily.

a. Normal O&M is performed by the contractor.

S U N

b. Logs indicate that wading pools were maintained daily.

S U N

Remarks:

Performance Indicator #8: "As-built" drawings are updated with changes and corrections.

a. The draftperson's initials accompany each change.

S U N

b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #9: An adequate library of equipment manufacturers' manuals is being maintained.

a. Manuals for new equipment have been obtained.

S U N

b. Obsolete manuals have been properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

Swimming Pool Questionnaire

NOTE: This questionnaire is to be completed monthly by the pool supervisor, lifeguard, or the QAE during an interview with the pool supervisor or lifeguard. Please circle the most appropriate answer to the question. Remarks, especially when the activity being evaluated is unsatisfactory, will be helpful in correcting the deficiencies.

1. How often does a pool maintenance person visit the pool area?

DAILY SELDOM NEVER

2. Are the work personnel neatly dressed and courteous?

YES NO

3. Do you experience difficulty receiving repair service during normal operating hours?

YES NO

4. Is repair work performed efficiently, and is the area cleaned up before the work personnel leave?

YES NO

5. Are you satisfied with the swimming pool water clarity and chlorine content?

YES NO

6. Is the pool area, including mechanical rooms, kept clean and neat?

YES NO

7. Remarks:

Signature _____

Title _____

Date _____

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